of two of his students, led to the invention of the barometer, and, in the hands of von Guericke, to the air pump. Torricelli knew well the Dialogues on Motion.

6. Finally, Galileo was an inspiring teacher and built up at Padua a great school of physics. Many of his students lodged under his own roof; helped him in his own garden; ate at his own table. He had his own workshop and employed his own mechanicians. Generous with his time, his energy and his money, master of a fine literary style, endowed with a keen sense of humor, familiar with the best that had been said and thought in the world, standing in the front rank of investigators, is it any wonder that young men of talent hastened to Padua from all parts of Europe? Could any higher compliment be paid to a teacher than the devotion exhibited by the youthful Viviani, a lad in his teens, for his master already some seventy years old and a "Prisoner in Acetri"? If deferred payments of the kind that teachers mostly depend upon ever get as far as the next world, surely this courageous spirit, harried throughout his long life by poverty, ill-health and the censorship of the church, must have been gratified by the work of the Accademia del Cimento which was, with the exception of a single man, composed entirely of his students. Mechanics was the one subject to which he was devoted consistently and persistently throughout his life; it was the subject of his earliest investigation when a young man at Pisa; the subject upon which he lectured when in his prime at Padua; the subject of his latest and most mature reflection at Arcetri. His most important contribution to dynamics was published in the seventy-third year of his age.

If, in conclusion, I were asked to summarize in a single sentence the principal contributions of Galileo to the science of physics, I should mention the two following facts: (1) That knowledge of physical phenomena which is to receive "impersonal verification" and become useful, must be obtained mainly by experiment adapted to ask of nature some particular question. (2) That momentum considered as a function of time and position is a fundamental dynamical concept; or, in other words, to discover how the change of momentum of any body is connected with the physical circumstances in which the body is placed, is the one great problem of dynamics.

But perhaps, after all, his most important contributions lie outside of physics. Indeed Galileo has not yet shot his last arrow. For his life still teaches us that nothing is so because any man says it is so. His example still shows how experiment can rob a man of all arrogance of opinion, how familiarity with unsolved problems can give a man genuine humility, and how, on the other hand, the possession of clear experimental evidence arms him with sure confidence.

Critics tell us that Florence, during the Renaissance, shone with a borrowed light —a light reflected from Athens. But I venture to think that those who will take the pains to look over the pages of Galileo will find them self-luminous.

Henry Crew
Northwestern University

Facts and Fiction about Crops

The Association of Official Agricultural Chemists of the United States at the Norfolk meeting, in 1907, unanimously adopted a commiteee report[1] endorsing the following declaration:

> It is as truly the duty of science to protect agriculture from error as it is to afford new truth.

[1] See Circular No. 123 of the University of Illinois Agricultural Experiment Station.

If "the farm is the basis of all industry," as was recently stated by James J. Hill, then science should not fail in this duty; for American agriculture is approaching a crisis, and the use of science must be depended upon to provide adequate support for our rapidly increasing population.

Already the question of food has begun to exert dangerous pressure in the United States, but so much of error and deception has been promulgated that even those who are to occupy the places of highest authority and influence are likely to be led into false positions whose foundations can only crumble beneath their feet.

There is no fiction in the starving poverty of our race in India, nor in the frequent famines of Russia, nor in the history of the dark ages following the ancient civilization of our people in the Mediterranean countries; and neither should the plans for the future prosperity of the Aryan in America be based upon fiction.

EXAGGERATED CROP REPORTS

Careful investigation reveals the fact that the reports from the federal bureau of statistics, as published by the secretary of agriculture, are highly exaggerated and deserving of the strongest condemnation, although all would be glad to give praise if these glowing reports were true; and, if the progeny of ninety-two million people and added millions of immigrants could live upon blind optimism or mere boasting, then duty would not compel this contribution toward the protection of truth and prosperity, by exposing error.

The following quotations are taken from the annual reports of the secretary of agriculture:

From 1905 Report.—Another year of unsurpassed prosperity to the farmers of this country has been added to the most remarkable series of similar years that has come to the farmers of any country in the annals of the world's agriculture. Production has been unequaled; its value has reached the highest figure yet attained.

From 1906 Report.—Economic revolution in the art and science of agriculture, which became noticeable in this country half a dozen years ago, has continued during 1906, with tremendous effect upon the nation's prosperity. Crops so large as to be beyond any rational comprehension have strained the freight-carrying ability of the railroads.

From 1910 Report.—Year after year it has been my privilege to record "another most prosperous year in agriculture." . . . Nothing short of omniscience can grasp the value of the farm products this year. At no time in the world's history has a country produced farm products within one year with a value reaching $8,926,000,000, which is the value of the agricultural products of this country for 1910. This amount is larger than that of 1909 by $305,000,000, an amount of increase over the preceding year which is small for the more recent years.

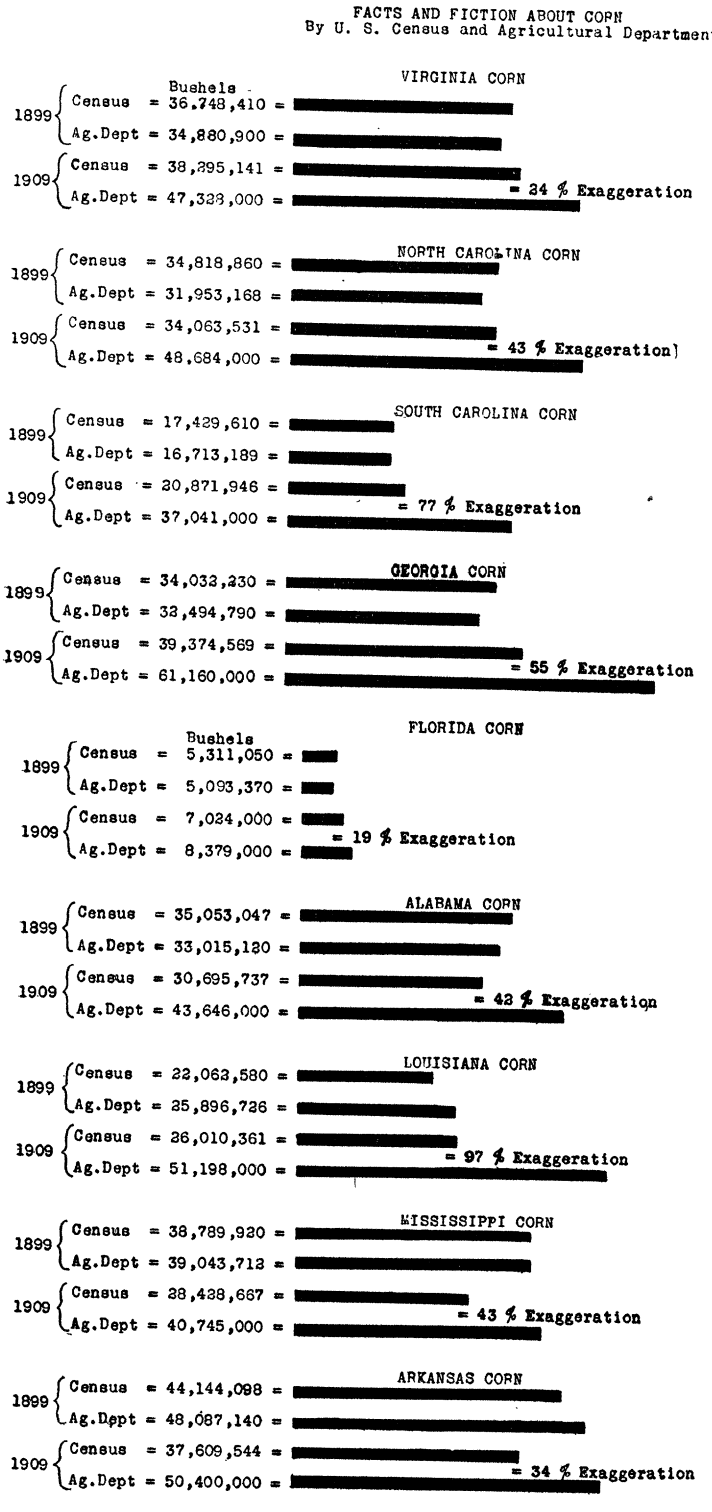
A notable feature of corn production this year is the growing importance of the south. This has been manifested in a small way in very recent years, but now the increased magnitude of the crop in that section, both absolute and relative to national production, forces itself upon the attention.

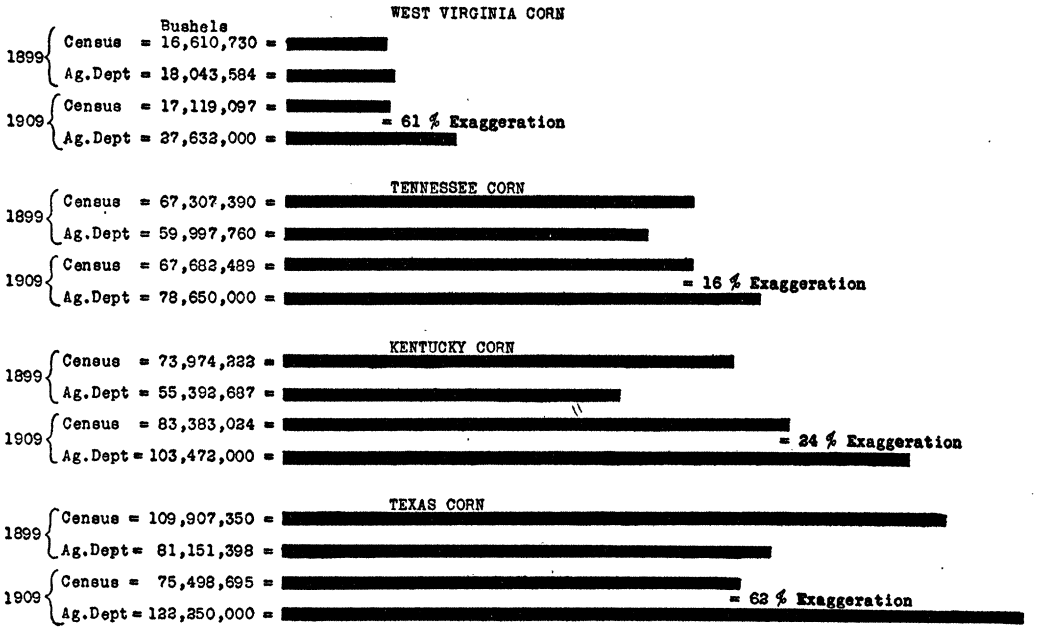
The demonstration work among southern farmers is rapidly increasing. Organized in 1904 for the purpose of fighting the boll-weevil in Texas, this work has now extended to all of the southern states. . . . From 1904 to 1909 there was an increase from 1 to 362 agents in the field. The number has now reached 450, and the demand for more is urgent. . . . In 1909 figures from a large number of demonstrators showed a comparative increase of from 50 to 400 per cent. in the average yield of standard crops, and the figures for 1910 indicate similar results.

From 1911 Report.—Owing to the prevalence of high prices there has developed a general impression that the agriculture of this country is unequal to the needs of the increasing population. An investigation of the facts with regard to this condition failed to establish any cause for alarm. On the contrary, it is evident that this country has been passing through phases of agriculture in which declines in production per acre are the result of exploiting new land and in which recuperation follows with a greater pace than that of increase of population.

The Department of Agriculture has had success in the south through object lessons in the field, where the best southern farmers in their counties were the instructors. This method should be organized in all the states.

From 1912 Report.—The record of sixteen years


FACTS AND FICTION ABOUT CORN
By U. S. Census and Agricultural Department
VIRGINIA CORN
Bushels
1899 Census = 36,748,410 =
Ag.Dept = 34,880,900 =
1909 Census = 38,295,141 =
Ag.Dept = 47,328,000 =
= 24 % Exaggeration
NORTH CAROLINA CORN
1899 Census = 34,818,860 =
Ag.Dept = 31,953,168 =
1909 Census = 34,063,531 =
Ag.Dept = 48,684,000 =
= 43 % Exaggeration
SOUTH CAROLINA CORN
1899 Census = 17,429,610 =
Ag.Dept = 16,713,189 =
1909 Census = 20,871,946 =
Ag.Dept = 37,041,000 =
= 77 % Exaggeration
GEORGIA CORN
1899 Census = 34,033,230 =
Ag.Dept = 33,494,790 =
1909 Census = 39,374,569 =
Ag.Dept = 61,160,000 =
= 55 % Exaggeration
FLORIDA CORN
Bushels
1899 Census = 5,311,050 =
Ag.Dept = 5,093,370 =
1909 Census = 7,024,000 =
Ag.Dept = 8,379,000 =
= 19 % Exaggeration
ALABAMA CORN
1899 Census = 35,053,047 =
Ag.Dept = 33,015,120 =
1909 Census = 30,695,737 =
Ag.Dept = 43,646,000 =
= 42 % Exaggeration
LOUISIANA CORN
1899 Census = 22,063,580 =
Ag.Dept = 25,896,726 =
1909 Census = 26,010,361 =
Ag.Dept = 51,198,000 =
= 97 % Exaggeration
MISSISSIPPI CORN
1899 Census = 38,789,920 =
Ag.Dept = 39,043,713 =
1909 Census = 28,438,667 =
Ag.Dept = 40,745,000 =
= 43 % Exaggeration
ARKANSAS CORN
1899 Census = 44,144,098 =
Ag.Dept = 48,087,140 =
1909 Census = 37,609,544 =
Ag.Dept = 50,400,000 =
= 34 % Exaggeration



has been written. It begins with a yearly farm production worth $4,000,000,000 and ends with $9,532,000,000. . . . During the past 16 years the farmer has steadily increased his wealth production year by year, with the exception of 1911. . . . Beginnings have been made in a production per acre increasing faster than the natural increase of population.

In the issue of February, 1913, of the *Crop Reporter*, "published by authority of the secretary of agriculture," occurs the following:

Statements have been made recently by some writers and lecturers, to the effect that the yield per acre of crops in the United States is diminishing from year to year. A study of crop yields indicates that there was such a tendency toward lower yields during the seventies and eighties, but during the last 20 years the tendency has been the reverse. . . . In order to show this trend graphically, eight charts are published in this issue of the *Crop Reporter* which show the yearly change and the average change of yield per acre of eight important crops. In these charts the downward tendency until about 1890, and since then the upward trend, is strikingly shown. The recent tendency toward enlarged production per acre is general throughout the United States.

By referring to the *Crop Reporter* for January, 1911, we find a similar statement:

That the final stage of better agriculture and increased production has been reached in many states for a varying number of crops, and that production per acre is not only beginning to exceed the normal increase of population, but really to exceed the actual increase. . . .

The potentiality of agricultural production as a national achievement sufficient for growth of population has been so numerously and so thoroughly demonstrated as to be now beyond intelligent question. The Farmers' Cooperative Demonstration Work, now carried on in 12 cotton states, employs 375 traveling agents and has many thousands of demonstrating farms. It is proving by results on thousands of farms that preparation of the soil so as to make the best seed bed adds 100 per cent. to the average crop on similar lands with an average preparation in the old way; that the planting of the best seed makes a gain of 50 per cent.; and that shallow, frequent cultivation produces an increase of another 50 per cent., making a total gain of 200 per cent., or a crop three times the average crop.

It will be noted that all of this enormous increase is secured with no suggestion of soil enrichment, in strict harmony with the erroneous teachings[2] of the Department's Bureau of Soils:

[2] See Bureau of Soils Bulletin, No. 55, pp. 66, 79, 80; or SCIENCE, November 8, 1912, p. 621.

The soil is the one indestructible, immutable asset the nation possesses. It is the one resource that can not be exhausted; that can not be used up. . . . It is evident that it can not wear out, that so far as the mineral food is concerned it will continue automatically to supply adequate quantities of the mineral plant foods for crops. . . . As a national asset the soil is safe as a means of feeding mankind for untold ages to come.

CROP ESTIMATES MEASURED BY THE CENSUS

Fortunately, there is a trustworthy measure applied to the progress or retrogression of this country every ten years, when every farmer and land owner in all the states must make a sworn statement to the Bureau of Census in regard to his crops and herds; and, fortunately this statement is not subject to subsequent revision or inflation by any "estimates" of the "Crop Reporting Board" with an "optimistic" secretary of agriculture as the chairman.

Thus, while the "crop statistics" of the agricultural department claim an increase of 50 per cent. in the production of corn in the southern states from 1899 to 1909, the data from the U. S. Bureau of Census show an actual decrease of 7 per cent. In other words, the Department of Agriculture reports that the total production of corn for the thirteen states from Texas and Arkansas to the Atlantic, and south of the Ohio and Potomac, was increased by 239 million bushels from 1899 to 1909; while the figures from the Bureau of Census prove that instead of an increase there was a positive decrease of 31 million bushels.

The accompanying statistical data and graphic illustrations reveal the percentage of inflation or boasting by the agricultural department as compared with the census facts relating to corn production in the individual states.

STATISTICAL ILLUSTRATIONS

The census reveals an increase in the population of contiguous continental United States of 21 per cent. during the last decade (from 76 million to 92 million people). The Bureau of Census also found an increase of 4.8 per cent. in farm land, and increase of 15.4 per cent. in *farmed* land, which means the land used for the production of crops, including pasture for live stock.

But has our increased production per acre amounted to more than 21 per cent., as the above quotations would lead us to believe? If so, our total increase in production should be 39.6 per cent., considering that we are farming 15.4 per cent. more acres. But the report of the Bureau of Census shows only 1.7 per cent. increase in the total production of all cereal crops, including corn, wheat, oats, barley, rye, rice, buckwheat, Kafir corn, emmer and spelt, the aggregate production having been 4,439 million bushels in 1899 and 4,513 million bushels in 1909; and a comparison of the crop "statistics" of the Department of Agriculture for these years with the averages for the three-year periods, 1898 to 1900, and 1908 to 1910, respectively, shows that, on the whole, 1909 was a slightly more favorable season than was 1899, for the production of the cereal crops.

An increase of 15.4 per cent. in farmed land with an increase of only 1.7 per cent. in production reveals the truth of reduced yield per acre. And neither official "estimates" nor official boasting can controvert this established American fact.

SHORTAGE OF ANIMAL PRODUCTS

We might expect and hope that a much larger increase would be found in the live stock produced during the decade on the farms of the United States, but instead we find no increase at all. In fact, the number of cattle decreased by six million (from 68 to 62 million head); the swine decreased by five million (from 63 to 58 million head); and the sheep decreased by nine million (from 62 to 53 million head); while horses and mules increased by less than three million (from 22½ to 24 million on farms, and from 25 to 27½ million all told, including those in cities).

(The time of year the counts were taken varied by six weeks, June 1, for 1900, and April 15, for 1910, but even with possible allowances for this variation, the number of

cattle, sheep and swine plainly decreased during the decade.)

THE TRUTH ABOUT COTTON

The cotton crop showed a substantial increase of 11.7 per cent. in total production, and, furthermore, 1909 seems not to have been a favorable season for cotton; but, on the other hand, the acreage in cotton increased by 32 per cent. from 1899 to 1909; and the combined reports of the Department of Agriculture (on acreage) and of the Bureau of Census (on production) reveal the fact that the yield per acre of cotton was not only less in 1909 than in 1899, but the average yield per acre for the four years 1907, 1908, 1910 and 1911, was also less than the average for the four years 1897, 1898, 1900 and 1901. This notwithstanding the boasted influence of the hundreds of "best southern farmers in their counties," who accepted appointments on the Department's pay roll as "field agents"; and it is a question of exceeding importance whether the "farm demonstrators" of either the south or the north should be appointed by the secretary of agriculture. Should they not rather be appointed by the agricultural colleges of the respective states, in order that they may be selected because of their thorough training in the scientific principles which must constitute the foundation of truly permanent systems of agriculture, as well as for their knowledge and experience in the science and practise of agriculture in their own state, and be held directly responsible to their home people? There is the gravest danger that a federal appointee in every county will often exert more influence politically than agriculturally.

POTATOES INCREASE

The reports of the Bureau of Census show that the only important increase in crops of large significance for food is in potatoes, a crop that is grown to a considerable extent on the market gardens enriched by heavy applications of animal fertilizers from the city, produced, of course, at the expense of the farms which supply the cities with hay and grain.

DECREASE IN EXPORTATIONS

When we consider the facts revealed by the Bureau of Census, it is not strange that, in order to feed our increasing population, we were compelled to decrease our exportation of wheat for making bread, and of corn for making meat. As an average of the first four years of Secretary Wilson's administration (1897 to 1900), compared with the average for 1907 to 1910, our annual exportations decreased from 210 million to 108 million bushels of wheat, and from 196 million to only 49 million bushels of corn. (These are not estimates, but facts.) In percentage of total "estimated" production, the corn exports decreased from 10 per cent. to 2 per cent., and wheat exports decreased from 37 per cent. of our production for 1897 to 1900, to only 16 per cent. of the production for 1907 to 1910.

THE GREATEST DECEPTION

And yet, if we ignore the census facts, and accept only the "estimates" of the Department of Agriculture, a comparison of averages of the "statistics" for these two four-year periods would show that, after deducting the actual exportations, our average annual supply for domestic consumption increased during the decade from 359 million to 575 million bushels of wheat, and from 1,806 million to 2,741 million bushels of corn; or, in other figures, these four-year averages would show that our supply of wheat for bread increased during the decade by 60 per cent., and that our domestic supply of corn for the production of meat, etc., increased by 52 per cent.; whereas, our population increased by only 21 per cent. during the same decade.

Thus the only real basis for the common complaint of the people regarding the food supply is that they can not live on "statistical" fiction.

In his annual report for 1912, Secretary Wilson makes the following generous statement:

> The great and growing movement carried on by the department for agricultural betterment has not been sustained solely by one man.

It must also be recognized that the faults

of the department, including the condemnable inflation of crop "statistics," and the wide promulgation of erroneous theories, such as have emanated from the Bureau of Soils, advocating doctrines which can lead only to land ruin, are not all to be set down as the sins of one man. There have been in the service of the United States Department of Agriculture, some of the most eminent scientists the world affords, and other conscientious public servants, including, unquestionably, many of the field agents; and so have there been others whose public "service" is far worse than worthless.

Cyril G. Hopkins
University of Illinois

THE AMERICAN PHILOSOPHICAL SOCIETY AND PRESIDENT WILSON

On Wednesday of last week a committee of the American Philosophical Society consisting of President W. W. Keen, Hon. Charlemagne Tower, Hon. Elihu Root, Secretary Charles D. Walcott, of the Smithsonian Institution, President Robert S. Woodward, of the Carnegie Institution, and Director Otto H. Littmann, of the U. S. Coast and Geodetic Survey, were received by President Wilson, by special appointment in the east room of the White House, and presented to him, on behalf of the society, the following congratulatory address on his accession to the presidency.

To His Excellency Woodrow Wilson, President of the United States:

Sir: The American Philosophical Society extends its cordial congratulations to you, as one of its fellow-members, upon your accession to the presidency of the United States. You carry into public life the ideals of the scholar; and you will show in the New World, as has been proved so often in the Old, that philosophical training, in the best and broadest sense of the term, is a help to the practical statesman. Your studies in history and in political science will illuminate your task of giving to the nation a wise and strong government.

It was Montesquieu, the good genius of the makers of our national constitution, who said that for a safe voyage for the ship of state the spirit of the laws should serve as compass and history should be the chart. This society confidently believes that you have at your command this compass and this chart; that with your firm hand at the helm the ship of state will safely ride the seas; and that you, like those of your distinguished predecessors in the presidency who were its members, will help to make the future history of the nation worthy of its past.

Seven times since the founding of the Republic the American Philosophical Society has had cause for congratulation in the selection of one of its members as President of the United States. Washington, Adams, Jefferson, Madison, the second Adams, Buchanan and Grant were honored names upon its roll before the popular vote inscribed them in the list of American Presidents. To you, the eighth in turn of its members to enter upon this high office, this Society extends its warmest greeting.

Given under the seal and in the name of The American Philosophical Society held at Philadelphia for Promoting Useful Knowledge this seventh day of March, 1913.

W. W. Keen,
President
I. Minis Hays,
Arthur W. Goodspeed,
Amos P. Brown,
Harry F. Keller,
Secretaries

The president thanked the committee for the presentation of the address and later he made a more formal acknowledgment as follows:

The White House, Washington,
March 19, 1913.

My Dear Dr. Keen: May I not express to you, and through you to the members of the American Philosophical Society, my deep and sincere appreciation of the cordial message brought me from the society by you and your associates this afternoon?

Nothing has gratified me more. I do not know of any association whose confidence I would rather enjoy. It has been a matter of peculiar pride to me to be associated with the American Philosophical Society, and that that distinguished body should feel honored by my elevation to the Presidency is a source of genuine satisfaction to me. I can only say in reply to their gracious address that I shall hope and strive at all times to deserve their respect and confidence.

Cordially and sincerely yours,
Woodrow Wilson.

Dr. William Keen,
Philadelphia, Pa.